REMARKS

Claims 1-21 are pending in the Application and all were rejected in the Office action mailed February 21, 2007. Claims 1, 8, 10, and 17 are amended by this response. Claims 1, 8, 10, and 17 are independent claims. Claims 2-7, 9, 11-16, and 18-21 depend from independent claims 1, 8, 10, and 17, respectively.

Applicant respectfully requests reconsideration of pending claims 1-21, in light of the following remarks.

Objections to the Specification

The Abstract was objected to because it is preceded by the text of the title. Applicant has amended the Abstract to delete the title text, believes that the objection to the Specification is overcome, and respectfully requests that the objection to the Specification be withdrawn.

Rejections of Claims

Rejections Under 35 U.S.C. §101

Claims 1-21 were rejected under 35 U.S.C. §101. With regards to claims 1-9, the Office action alleges that "...the claims disclose a process (method) that manipulates only number [sic], abstract concepts or ideas or representing [sic] any of the foregoing, the claims are not being applied to an appropriate subject matter." With regards to claims 10-21, the Office action alleges that "...the claims call for a seemingly patentable process but in reality seeking [sic] patent protection on an abstract idea as evidenced by claims 1-9." (Office action at page 2) Applicant respectfully traverses the rejection.

Applicant forcefully disagrees and submits that independent claims 1, 8, 10, and 17 are directed to tangible and concrete subject matter, and not merely mathematical

calculations, abstract concepts and ideas as alleged by the Examiner. With regard to independent claim 1, Applicants respectfully submit that claim 1 is directed to a method of operating a communication system to reduce echo of a narrowband first signal in a wideband second signal, and calls for "receiving the first signal having spectral components within a first frequency band; accepting the second signal having spectral components in a second frequency band comprising the first frequency band and having spectral components extending beyond the first frequency band; removing a modified version of the first signal from the second signal to produce a third signal; and processing the third signal based upon a level of spectral components of the second signal extending beyond the first frequency band, to further reduce echo of the first signal in the third signal." Note that claim 1 has been amended to further clarify the subject matter of the claim. Applicant respectfully submits that these amendments were not necessary in order for the claim to be directed to statutory subject matter. Nevertheless, said amendments are made herewith to expedite the prosecution and allowance of the application by clarifying for the Examiner that claim 1 is directed to a practical method that results in a tangible and concrete result. Applicant submits that the utility of the method of claim 1 is self-apparent from a reading of the claim. If the usefulness of the subject matter of claim 1 escapes the Examiner, Applicant respectfully suggests the Examiner review the specification at, for example, paragraphs [0030]-[0038], which makes readily apparent the utility of the invention of claim 1. In view of the foregoing, Applicant submits that claim 1, and all claims depending therefrom, are directed to statutory subject matter in accordance with 35 U.S.C. §101.

With regard to Independent claim 8, Applicant respectfully submits that claim 8 is directed to a method of operating a communication system, and recites "receiving a first signal having a first bandwidth; processing the first signal to produce a second signal having a second bandwidth that is a subset of the first bandwidth; and wherein the communication system detects the occurrence of the first signal based upon at least one characteristic of the first signal that is not present in the second signal." Note that claim 8 has been amended to further clarify the subject matter of the claim. Applicant respectfully submits that these amendments were not necessary in order for the claim to

be directed to statutory subject matter. Nevertheless, said amendments are made herewith to expedite the prosecution and allowance of the application by clarifying for the Examiner that claim 8 is directed to a practical method that results in a tangible and concrete result. Applicant respectfully submits that the utility of the method of claim 8 is self-apparent from a reading of the claim. If the usefulness of the subject matter of claim 8 escapes the Examiner, Applicant respectfully suggests the Examiner review the specification at, for example, paragraphs [0030]-[0038], which makes readily apparent the utility of the invention of claim 8. In view of the foregoing, Applicant respectfully submits that claim 8, and all claims depending therefrom, are directed to statutory subject matter in accordance with 35 U.S.C. §101.

With regard to independent claim 10, Applicant respectfully submits that claim 10 is directed to a computer-readable storage, having stored thereon a computer program having a plurality of code sections for operating a communication system to reduce echo of a narrowband first signal in a wideband second signal, the code sections executable by a processor for causing the processor to perform the operations comprising "receiving the first signal having spectral components within a first frequency band; accepting the second signal having spectral components in a second frequency band comprising the first frequency band and having spectral components extending beyond the first frequency band; removing a modified version of the first signal from the second signal to produce a third signal; and processing the third signal based upon a level of spectral components of the second signal extending beyond the first frequency band, to further reduce echo of the first signal in the third signal." Note that claim 10 has been amended to further clarify the subject matter of the claim. Applicant respectfully submits that these amendments were not necessary in order for the claim to be directed to statutory subject matter. Nevertheless, said amendments are made herewith to expedite the prosecution and allowance of the application by clarifying for the Examiner that claim 10 is directed to a practical method that results in a tangible and concrete result. It is readily apparent from a cursory reading of claim 10 that it is directed to more than "an abstract idea", as asserted by the Examiner. Independent claim 10 is a Beauregard claim directed to a computer readable medium storing a plurality of executable code section for

performing the method of claim 1. The Beauregard claim format is a widely accepted claim format. See In re Beauregard, 35 USPQ2d 1383 (Fed. Cir. 1995). Beauregard claims comply with 35 U.S.C. §101 so long as the instructions stored on the computer readable medium define a method that constitutes statutory subject matter, i.e., produces a tangible, concrete and useful result. Applicant submits that the subject matter of claim 10 complies with 35 U.S.C. §101 for at least the reasons asserted above with respect to claim 1. In view of the foregoing, Applicant respectfully submits that claim 10, and all claims depending therefrom, are directed to statutory subject matter in accordance with 35 U.S.C. §101.

With regard to independent claim 17, Applicant respectfully submits that claim 17 is directed to a signal processing device for reducing echo of a narrowband first signal in a wideband second signal. Claim 17 recites that the device comprises "a first input for receiving a first signal comprising energy in a first frequency band; a second input for receiving a second signal comprising energy in a second frequency band comprising the first frequency band and having spectral components extending beyond the first frequency band; an echo canceller that receives the first signal and the second signal, the echo canceller producing a third signal; and a non-linear processor that attenuates the third signal based upon a level of energy extending beyond the first frequency band of the second input, to further reduce echo of the first signal in the third signal." Note that claim 17 has been amended to further clarify the subject matter of the claim. Applicant respectfully submits that these amendments were not necessary in order for the claim to be directed to statutory subject matter. Applicant respectfully submits that it is readily apparent from a cursory reading of claim 17 that it is directed signal processing device, which is more than "an abstract idea", as asserted by the Examiner. Applicant respectfully submits that the subject matter of claim 17 complies with 35 U.S.C. §101 for at least the reasons asserted above, and with respect to claim 1. In view of the foregoing, Applicant respectfully submits that claim 17, and all claims depending therefrom, are directed to statutory subject matter in accordance with 35 U.S.C. §101.

For at least the reasons set forth above, Applicant respectfully submits that claims 1-21 are directed to statutory subject matter per 35 U.S.C. §101, and respectfully requests that the rejection of claims 1-21 under 35 U.S.C. §101, be withdrawn.

Rejections Under 35 U.S.C. §112

Claims 1-21 were rejected under 35 U.S.C. §112, first paragraph. The Office action alleges that "…the claimed invention is not supported by either an asserted utility or a well established utility for the reasons set forth above, one skilled in the art clearly would not know how to use the claimed invention." (Office action at pages 2 and 3) Applicant respectfully traverses the rejection. According to M.P.E.P. §2106(II) at page 2100-5:

> "…USPTO personnel will review the complete specification, including the detailed description of the invention, any specific embodiments that have been disclosed, the claims and any specific, substantial, and credible utilities that have been asserted for the invention." (emphasis added)

Applicant respectfully submits that, contrary to the allegation of the rejection, claims 1-21 of the Application are supported by an asserted utility, and that one skilled in the art clearly would know how to use the claimed invention, as demonstrated, at least, in paragraphs [0030-0038] of the Application, which state:

> "Referring now to FIGURE 1A, there is illustrated a flow diagram describing the provisioning of signal processing functions designed for digital samples of signals sampled at a particular rate to digital samples of a signal sampled at a higher rate. The flow diagram will be described in conjunction with FIGURES 1B-1G. The functions can comprise, for example, software functions. At 5, digital samples representing a signal are received. FIGURE 1B is a graph of an exemplary signal. Those skilled in the art will recognize that a signal can

be represented by a series of frequency components. FIGURE 1C is an exemplary graph representing the magnitude of frequency components as a function of frequencies. Digitizing the input signal generates digital samples. FIGURE 1D is a graph representing the digitization of the signal in FIGURE 1B at X samples/sec. As can be seen, the digitized representation of the signal loses some of the information in the original signal. The amount of information lost is dependent on the sampling rate. Those skilled in the art will recognize that the information lost during the digitization comprises the frequency components exceeding one-half the sampling rate. For example, an input signal sampled at 16,000 samples/sec. loses the information in the frequency components exceeding 8 KHz. FIGURE 1E is an exemplary block diagram of frequency components for a signal digitized at X samples/sec.

The digital samples received at 5 represent an input signal that is sampled at a higher sampling rate and representing a higher bandwidth, than the sampling rate and bandwidth for which the signal processing functions are designed. For example, a software function may be designed to process a signal sampled at X samples/sec. (X/2 bandwidth), while the input signal is sampled at 2X samples/sec (X bandwidth).

In order to provide an appropriate input signal to the software functions, the digitized input signal is split (10) into a low band and a high band. The low band is the digitized samples of the signal resulting from the frequency components that are less than a predetermined frequency, wherein the frequency is less than or equal to the highest

frequency in the band for which the processing function was designed. The high band is the resulting digitized signal from the frequency components greater than the predetermined frequency.

For example, signal processing functions designed for signals sampled at X samples/sec. can be provided to a input signal sampled at 2X samples/sec. by splitting the input signal into a low band comprising the digitized signal resulting from frequency components between 0 and X/2, and a high band comprising the digitized signal resulting from the frequency components between X/2 and X. FIGURES 1F is a digitized representation of a signal at 2X samples/sec. FIGURE 1G is an exemplary graph of the magnitude of frequency components of a signal digitized at 2X samples/sec. The low band is a signal resulting from the frequency components 0 to X/2 and the high band is a signal resulting from the frequency components X/2 to X.

The frequency components 0 to X/2 can be digitized by X samples/sec. Thus the signal processing function can be provided to the low band signal. At 15, the signal processing functions designed for the lower bandwidth process the low band signal. Signal processing functions that are designed for the larger bandwidth process both the low band signal and the high band signal (20).

At 25, the low band signal and high band signal are recombined. The combined signal can be further processed or output. For example, recombined signal can be packetized and provided to a transceiver for transmission over a network.

Alternatively, the recombined signal can be provided to an output device, such as a speaker.

As can be seen, the foregoing provides a scheme wherein processing functions designed to operate on a signal with a particular sampling rate can be provided to a signal sampled at a higher rate. In one embodiment of the present invention, the foregoing scheme can be utilized to provide the functionality of software designed for an audio signal represented by digital samples within a particular bandwidth, to an audio signal represented by digital samples within a higher bandwidth.

The human ear can hear audio frequencies within approximately 0-4 KHz, with greater audibility at the lower frequencies and lesser audibility at the higher frequencies. Therefore, the portion of an audio signal that is detectable by the human ear can be represented by 8000 samples/sec. Accordingly, many software programs providing signal processing for audio signals, known as services, were designed for an input signal represented by 8000 samples/sec. and a 0-4 KHz bandwidth. For example, the public switched telephone network in the United States uses 8000 8-bit samples per second to represent a voice signal. The foregoing is known as narrowband sampling. However, significant improvements in quality have been observed when audible sound is sampled at a 16 KHz (16,000 samples/sec) representing the 0-8 KHz bandwidth. The foregoing is referred to as wideband sampling.

> Many voice communication networks, such as voice over packet networks support wideband sampled speech. Additionally, the voice over packet networks support narrowband sampled speech. Narrowband sampled speech is supported to interface with the public switched telephone network as well as to allow for use of preexisting terminals which sample speech at the narrowband rate. The foregoing invention can be utilized to provide functionality of services designed for narrowband sampled signals to wideband sampled signals." (emphasis added)

Applicant respectfully submit that even a cursory review of these first nine paragraphs of the "Detailed Description" portion of the Application would be sufficient for one of ordinary skill in the relevant art to immediately and unquestioningly recognize that the Application sets forth support for an asserted utility, that is, to provide functionality of services designed for narrowband sampled signals to wideband sampled signals in voice over packet networks that support narrowband and wideband sampled speech.

Based at least upon the above, Applicant respectfully submits that, contrary to the assertion of the rejection, the claimed invention is supported by either an asserted utility or a well established utility for at least the reasons set forth above, and that one skilled in the art clearly would know how to use the claimed invention. Therefore, Applicant respectfully requests that the rejection of claims 1-21 under 35 U.S.C. §112, first paragraph, be withdrawn.

Rejections Under 35 U.S.C. §103

Claim 17 was rejected under 35 U.S.C. 103(a) as being unpatentable over Shiraki (US 5,884,194) in view of Nakagawa et al. (US 5,774,561, hereinafter "Nakagawa"). The Applicants respectfully traverse the rejection.

The Applicant respectfully submits that the Examiner has failed to establish a case of *prima facie* obviousness for at least the reasons provided below. M.P.E.P. §2142 clearly states that "[t]he examiner bears the initial burden of factually supporting any *prima facie* conclusion of obviousness." The M.P.E.P. §2142 goes on to state that "[t]o establish a *prima facie* case of obviousness, three basic criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations. The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, and not based on applicant's disclosure."

With regard to amended claim 17, Applicant respectfully submits that Shiraki and Nakagawa, take alone or in combination, fail to teach, suggest, or disclose, for example, a signal processing device for reducing echo of a narrowband first signal in a wideband second signal, the device comprising a first input for receiving a first signal comprising energy in a first frequency band; a second input for receiving a second signal comprising energy in a second frequency band comprising the first frequency band and having spectral components extending beyond the first frequency band; an echo canceller that receives the first signal and the second signal, the echo canceller producing a third signal; and a non-linear processor that attenuates the third signal based upon a level of energy extending beyond the first frequency band of the second input, to further reduce echo of the first signal in the third signal.

More specifically, Applicant respectfully submits that the Office action fails to show where Shiraki and Nakagawa, taken alone or in combination, teach or suggest "…an echo canceller that receives the first signal [comprising energy in a first frequency band] and the second signal [comprising energy in a second frequency band comprising the first frequency band and having spectral components extending beyond the first frequency band], the echo canceller producing a third signal…", and "…a non-linear

processor that attenuates the third signal based upon a level of energy extending beyond the first frequency band of the second input, to further reduce echo of the first signal in the third signal." The Office action asserts that Shiraki teaches "...an echo canceller that receives the first signal and the second signal, the echo canceller producing a third signal (Shiraki fig. 7: echo canceller 5 receives 2 signals and outputs D(k));..." (Office action, page 3) Applicant respectfully disagrees. Shiraki describes Figure 7 as "...a block diagram illustrating the construction of the echo canceller within the echo processing unit 25A in a third embodiment according to the present invention." (column 6, lines 47-49) Applicant respectfully submits that Shiraki does not describe element 5 of Figure 7 as an "echo canceller", but rather as an "echo canceller amount calculation means", which is an element of, but different from, an "echo canceller". Therefore, Applicant respectfully submits that element 5 of Figure 7 of Shiraki does not teach the "echo canceller" of Applicant's claim 17.

Applicant respectfully submits that while element 5 of Figure 7 is illustrated as having two inputs, Ls(k) and Lu(k), Shiraki fails to set forth any teachings that Ls(k) comprises energy in a first frequency band and Lu(k) comprises energy in a second frequency band comprising the first frequency band and having spectral components extending beyond the first frequency band, or vice versa. Shiraki is silent with respect to the spectral content of the Ls(k) and Lu(k) signals. Applicants appreciate recognition in the Office action that "Shiraki does not teach that the inputs into echo canceller 5 are in a first frequency band and a second frequency band." (Office action, page 3) To overcome this shortcoming, however, the Office action relies on Nakagawa, alleging that "Nakagawa 5774561 teaches that inputs into echo canceller are in a first frequency band and a second frequency band (Nakagawa fig. 2; paragraph 8: "FIG. 2 illustrates a conventional subband acoustic echo canceller disclosed in the aforementioned U.S. Pat., which divides the frequency band of the received signal x(n) into N subbands and cancels an echo in each subband.")" (Office action, page 3) (Applicant respectfully notes that there is no paragraph numbered 8 in Nakagawa.)

According to Nakagawa, at column 2, lines 4-39:

"FIG. 2 illustrates a conventional subband acoustic echo canceller disclosed in the aforementioned U.S. Pat., which divides the frequency band of the received signal x(n) into N subbands and cancels an echo in each subband. The parts corresponding to those in FIG. 1 are identified by the same reference numerals. In FIG. 2, reference numerals 18X and 18Y denote A/D converters, 19 a D/A converter, 20 and 30 echo signal subband analysis parts, 40 a subband synthesis part, 15_k each subband estimated echo path, 16_k each subband echo path estimation part and 17_k each subband subtractor. In this instance, k=0,1, . . . ,N-1. Assume that the full bandwidth of the received signal x(n) is rated with a width 2π from $-\pi$ to $+\pi$, for instance, and the division of the entire frequency band into M (an even number equal to or greater than 2) is to obtain N subband signals x_k (n) from the received signal x(n) by N=(M/2+1) band-pass filters. The generation of such N subband signals will hereinafter be referred to as the division of the received signal x(n) into N subband signals.

The received signal x(n) from the A/D converter 18X is applied to the received signal subband analysis part 20, wherein it is divided into N subband signals x_k (m) (where k=0, . . . ,N-1). Similarly, the echo y(n) is divided by the echo subband analysis part 30 into N subband signals y_k (m). The received signal subband analysis part 20 and the echo subband analysis part 30 are exactly identical in construction.

The subband estimated echo paths 15_k (where k=0, . . . ,N-1) are provided which have a one-to-one correspondence with the divided subbands. The echo Y_k (m) can be reduced by subtracting therefrom an echo replica Y_k (m) from each subband estimated echo path 15_k by the subband subtractor 17_k. The resulting subband residues e_k (m)=y_k (m)-y_k

(m) are synthesized into the full-band residue e(n) in the subband synthesis part 40."

Applicant respectfully submits that the above portion of Nakagawa, containing text specifically cited by the Office action as teaching "...inputs into echo canceller are in a first frequency band and a second frequency band..." fails to teach or suggest, at least, "...an echo canceller that receives the first signal [comprising energy in a first frequency band] and the second signal [comprising energy in a second frequency band comprising the first frequency band and having spectral components extending beyond the first frequency band], the echo canceller producing a third signal...", as recited by Applicant's amended claim 17.

Applicant respectfully submits that instead, Nakagawa teaches a sub-band acoustic echo canceller that divides the frequency band of the received signal x(n) into N subbands signals, divides the echo signal y(n) into N subbands, and separately cancels echo in each of the N subbands. The N subbands into which the received signal x(n) and y(n) are divided are identical subbands. Applicant respectfully submits that Nakagawa actually teaches N echo cancellers each comprising a subband estimated echo path 15_k, a subband echo path estimation part 16_k and a subband subtractor 17_k. Nakagawa does not teach that the N subbands are overlapping, and Nakagawa fails to teach or suggest that any subband echo canceller (i.e., a subband estimated echo path 15_k, a subband echo path estimation part 16_k and a subband subtractor 17_k) receives a first signal comprising energy in a first frequency band and a second signal comprising energy in a second frequency band comprising the first frequency band and having spectral components extending beyond the first frequency band, in accordance with Applicant's amended claim 17. Applicant respectfully submits that Nakagawa fails to teach or suggest that the subband echo canceller of FIG. 2 "...receives [a] first signal [comprising energy in a first frequency band] and [a] second signal [comprising energy in a second frequency band comprising the first frequency band and having spectral components extending beyond the first frequency band], the

echo canceller producing a third signal…", in accordance with Applicant's amended claim 17. Applicant also respectfully submits that the subband acoustic echo canceller of FIG. 2 has only two inputs, x(n) and y(n). Nakagawa fails to teach or suggest that either input signal comprises energy in a second frequency band comprising a first frequency band of the other input and having spectral components extending beyond the first frequency band of the other input, in accordance with Applicant's amended claim 17. Therefore, Applicant respectfully submits that Nakagawa fails to teach or suggest at least this limitation of Applicant's claim 17. Applicant respectfully submit, therefore, that neither Shiraki nor Nakagawa teach or suggest "…an echo canceller that receives the first signal [comprising energy in a first frequency band] and the second signal [comprising energy in a second frequency band comprising the first frequency band and having spectral components extending beyond the first frequency band], the echo canceller producing a third signal…", as recited in Applicant's amended claim 17.

In addition, Applicant respectfully submits that the Office action fails to show where the combination of Shiraki and Nakagawa teaches or suggests "…a non-linear processor that attenuates the third signal based upon a level of energy extending beyond the first frequency band of the second input, to further reduce echo of the first signal in the third signal." Both Shiraki and Nakagawa are silent with respect to a non-linear processor.

Based at least upon the above, Applicant respectfully submits that the proposed combination of Shiraki and Nakagawa fails to teach or suggest all of the limitations of Applicant's claim 17, as required by M.P.E.P. §2142, that the Office action has failed to establish a *prima facie* case of obviousness, and that a rejection of claim 17 under 35 U.S.C. 103(a) cannot stand.

Therefore, Applicant believes that claim 17 is allowable, for at least the reasons set forth above. Applicant respectfully submits that claims 18-21 depend from allowable claim 17, and are also allowable, for at least the same reasons. Applicants respectfully request, therefore, that the rejection of claim 17 under 35 U.S.C. §103(a) be withdrawn.

Claim 21 was rejected under 35 U.S.C. §103(a) as being unpatentable over Shiraki in view of Nakagawa, and further in view of Park et al. (US 6,181,794, hereinafter "Park"). Applicant respectfully traverses the rejection. Applicant respectfully submits that claim 21 is a dependent claim depending from amended independent claim 17. Applicant believes that amended claim 17 is allowable over the proposed combination of references, in that Park fails to overcome the shortcomings of Shiraki and Nakagawa, as set forth above. Because claim 21 depends from allowable claim 17, Applicant respectfully submits that claim 21 is also allowable over the combination of Shiraki, Nakagawa and Park, for at least the same reasons. Applicant respectfully requests, therefore, that the rejected of claim 21 under 35 U.S.C. §103(a), be withdrawn.

Conclusion

In general, the Office Action makes various statements regarding claims 1-21 and the cited references that are now moot in light of the above. Thus, Applicants will not address such statements at the present time. However, Applicants expressly reserve the right to challenge such statements in the future should the need arise (e.g., if such statements should become relevant by appearing in a rejection of any current or future claim).

A Notice of Allowability is courteously solicited.

The Commissioner is hereby authorized to charge any additional fees associated with this communication, or credit any overpayment, to Deposit Account No. 13-0017.

Respectfully submitted,

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/Kevin E. Borg/
Kevin E. Borg
Reg. No. 51,486

McANDREWS, HELD & MALLOY, LTD.
500 West Madison Street
Suite 3400
Chicago, Illinois 60661
Phone (312) 775-8000
Facsimile (312) 775-8100